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# **ECDR-GC314-PCI/PMC FS Driver**

## **Demonstration Code Manual**

### **For vxWorks and WinNT/2K**

### **Revision 1.0**

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# Chapter 1 Introduction

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The ECDR-GC314-PCI/PMC software driver is shipped with demonstration software that provides an example of the software driver's use. The demonstration software is a full functioning data collection software, which you can use immediately to operate the hardware. This manual describes the hardware setup required to run the demonstration software and the internals of the demonstration software itself.

This chapter provides the hardware test setup and technical support information.

## Overview

The demonstration software, although much more simplified than what is used in an actual data collection application, is provided with the ECDR-GC314-FS board to perform the following:

- Configure receiver channels and collect data using the ECDR-GC314-FS driver interface
- Demonstrate the functionality supported by the ECDR-GC314-FS board

The following paragraph summarizes the hardware setup, configuration of the receiver channels, and the data collection process performed by the demonstration software.

After you have installed the ECDR-GC314-FS board in your system, you connect the external clock input and channel 1 A/D input as described in the section “Hardware Setup” in this chapter. The clock used for all the examples provided in the demonstration software is 80.0 MHz. The specific channel 1 input frequency depends on which example you use, as described in Tables 3-2 through 3-5. Next, you select an initialization file to configure the receiver channels (i.e., down-conversion, digital filtering, etc.). After the receiver channels are configured, you select the mode of data collection supported by the module from a (name menu). After configuration is completed, the program turns on collection. The A/D digitizes the input signal, which can be further down-converted and filtered by either the Echotek Internal Wideband Receiver or the GC4016 receivers. As the input signal is digitized, Data Frames are formed and stored into the sample FIFO memory of each enabled receiver channel. Once data has been acquired, the software reads the data from the board and stores it into text files. These text files then can be imported to many data analysis tools for examination.

## GC4016 Programming

The hardware configuration information is stored in a formatted text file called a hardware initialization file (.ini) and is used by the software to program the GC4016 receiver chips. This information enables the GC4016 chip to process the digitized data in four-, two-, or one-channel modes. The demonstration software prompts you to choose from a list of standard .ini files that are shipped with the demo software. Refer to *Chapter 3 Initialization Files* for more information on the .ini files.

After the data is collected, the demonstration software reads the data from the sample FIFO memory and stores the data into text files. *Chapter 4 Runtime Procedure* provides the format of the data files. The data analysis tool MathCad<sup>®</sup> is then used to examine the data.

## Getting Started

Before running the ECDR-GC314-FS demonstration software, ensure that your equipment meets the following requirements:

- For a PC environment
  - A PC with a PCI bus that supplies 3.3V to the PCI board
  - Windows NT 4.0 or 2000
- For a VxWorks environment
  - A SBC with a PCI bus that supplies 3.3V to the PCI board
  - VxWorks 5.4.1

## Hardware Setup

Table 1-1 provides the required hardware setup and the external inputs required for the setup.

**Table 1-1 External Inputs for the ECDR-GC214-PCI/PMC**

<b>Test Setup Hardware</b>	<b>Description</b>
IF Input Source: RF Signal Generator	Amplitude = +4dBm Frequency = Refer to tables 3-2 to 3-5. Signal Generator should be as good as is available (for example, minimum distortion, harmonics, and phase noise).
Clock Source: RF Signal Generator	Amplitude = +4dBm Frequency = 80MHz Signal Generator should be as good as is available (for example, minimum distortion, harmonics, and phase noise).
BNC Cables	Good quality BNC Male to BNC Male cables
BNC to SMA Adapters	BNC Female to SMA Male adapters

## Technical Support

If you need additional technical information or assistance, contact the software department.

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## **Chapter 2 Initialization Files**

This chapter describes and shows the ECDR-GC314-FS hardware initialization file. The GrayChip4016 receivers are programmed according to the initialization file. Data is then collected and stored in data files located in the `./data` directory.

## File Description

The ECDR-GC314-FS hardware initialization file is composed of three sections as follows.

### First Section

This section defines the FIFO mode of the GC4016 receiver FIFOs and contains the switch to enable collection on any of the 12 available GrayChip channels or the raw/IWB channel on the board. This switch takes the following form:

CHANNEL\_ENABLE= [ **x**, **y**, **z** ] where data from channels **x**, **y** and **z** will be collected.

The following are valid channel notations:

iwb, IWB : Collect from raw A/D or IWB receiver FIFO

[1-3][1-d] : Collects from GrayChip receiver channels. There are three GrayChips available and four available channels within each GrayChip. To specify collection from all channels within the first GrayChip, the switch will take the form CHANNEL\_ENABLE[1a, 1b, 1c, 1d ].

### Second Section

This section contains the programming information for the GrayChip GC4016 global control registers. This switch selects which GrayChips are to be programmed with the information that follows. The switch takes the following form:

GRAY\_CHIP= [ ]

and the valid chip selects are 1, 2, and 3.

### Third Section

This section defines the specific programming information for the receiver channel. This section is preceded by a channel switch, GRAY\_CHIP\_CHANNEL= [ ], which has the same format as the channel enable switch. This switch selects which receiver channels are to be programmed with the information that follows the channel switch.

For more information on programming the GC4016, refer to the *GC4016 Chip Data Sheet*.

The following table describes the initialization file input fields for GC314-related configuration.

Field	Options	Description
GC314_FIFO_MODE	EXTRAWIDEBAND = 1 queue mode WIDEBAND = 2 queues mode NARROWBAND = 4 queues mode	Configures the GrayChip receiver collection FIFO. This should match the output settings of the GrayChip receivers.

For more information on programming the GC314 registers, please refer to the *ECDR-GC314-FS User's Manual*.

## Initialization Files

Table 2-1 lists and describes the initialization files included with the demonstration software. This section lists the configuration specifications provided by each sample initialization file.

**Table 2-1 ECDR-GC314-FS Initialization Files**

Initialization files	Description
gc314fsGsm12Ch.ini	12 channels, narrowband output. 4 output channels per GrayChip.
gc314fs_wb.ini	6 channels, wideband output. 2 output channels per GrayChip.
gc314fs_ewb.ini	3 channels, extra wideband output. 1 output channel per GrayChip.
rawAd.ini	Raw A/D or IWB collection.

## One-Channel Extra Wideband

In the one-channel extra wideband example, the four receiver channels (GC4016 channels A, B, C, and D) are combined into one extra wideband receiver channel with one fourth the minimum decimation of a single, uncombined receiver channel.

Table 2-2 describes the specifications for the ECDR-GC314-PCI/PMC board, when it is configured for One-Channel Wideband, as provided by the following initialization file: gc314fs\_ewb.ini

**Table 2-2 Configuration for One-Channel Extra Wideband**

Configuration Specifications	Description
A/D and Receiver Input Sample Rate	80.0 MHz
Number of Receiver Channels	1
Receiver Decimation	8
Down Convert Frequency	<i>User programmable in the configuration menu</i>
Data Output Sample Rate	10.0 MHz
Passband Width	64.0 MHz (80%)
Input Signal	<i>User selectable based on user specified down convert frequency.</i>
Output Signal	<i>Based on down convert frequency and input signal frequency.</i>

## Two-Channel Wideband

The Two-Channel Wideband example combines pairs of receiver channels to make two complete receiver channels (GC4016 channels A and B; C and D), each with half the minimum decimation of a single, unpaired receiver channel.

Table 2-3 describes the specifications for the ECDR-GC314-FS board, when it is configured for two-channel wideband, as provided by the following initialization file: gc314fs\_wb.ini

**Table 2-3 Configuration for Two-Channel Wideband**

Configuration Specifications	Description
A/D and Receiver Input Sample Rate	80 MHz
Number of Receiver Channels	2
Receiver Decimation	16
Down Convert Frequency	<i>User programmable in the configuration menu</i>
Data Output Sample Rate	5 MHz
Passband Width	4 MHz (80%)
Input Signal	<i>User selectable based on user specified down convert frequency.</i>
Output Signal	<i>Based on down convert frequency and input signal frequency.</i>

## Four-Channel Narrowband

The four-channel example is configured for four narrow-band outputs per GrayChip receiver, 12 channels total output channels.

Table 2-4 describes the specifications for the ECDR-GC314-FS board, when it is configured for two-channel wideband, as provided by the following initialization file: gc314fsGsm12ch.ini

**Table 2-4 Configuration for Four-Channel Narrowband (GSM)  
(16-Bit Complex Samples Mode)**

Configuration Specifications	Description
A/D and Receiver Input Sample Rate	80.0MHz
Number of Receiver Channels	4
Receiver Decimation	256
Down Convert Frequency	<i>User programmable in the configuration menu</i>
Data Output Sample Rate	312.5 KHz
Passband Width	250 KHz
Input Signal	<i>User selectable based on user specified down convert frequency.</i>
Output Signal	<i>Based on down convert frequency and input signal frequency.</i>

## Sample Initialization File

```
#-----#
#-:                                         : - #
#-: Name          : gc314fsGsm12Ch. ini      : - #
#-: Created by    : Lee/g. c.                  : - #
#-: Creation Date : 10-19-00                  : - #
#-:                                         : - #
#-:                                         : - #
#-: Description   :                          : - #
#-:                                         : - #
#-:                                         : - #
#-:                                         : - #
#-:                                         : - #
#-----#
```

  

```
#-----#
#-:          Board Wide Configuration      : - #
#-----#
GC314_FIFO_MODE= NARROWBAND  #-: NARROWBAND
                             #-: WIDEBAND
                             #-: EXTRAWIDEBAND
```

  

```
#-:-----: - #
#-: Specify what channel(s) to collect from      : - #
#-: Available selection:                         : - #
#-: iwb, IWB : RAW AD Data or IWB collection    : - #
#-: [1-3][a-d] : GrayChip channel collection      : - #
#-:                                         : - #
#-:-----: - #
CHANNEL_ENABLE= [ 1a, 1b, 1c, 1d, 2a, 2b, 2c, 2d, 3a, 3b, 3c, 3d ]
```

```
#-----#
#-:          Receiver Section          :-#
#-----#
#-:-----:-#
#-: Gray Chip Config. (1 - 3) :-#
#-:-----:-#
GRAY_CHIP= [ 1, 2, 3 ]
#-: Register Name      Register Value      Register Width :-#
#-:-----:-#
N_CHANNELS_OUT=          03                  #-: 8 Bits  :-#
N_MULTIPLIES=            07                  #-: 8 Bits  :-#
FILTER_SELECT=            00                  #-: 8 Bits  :-#
FINAL_SHIFT=              14                  #-: 8 Bits  :-#
CHANNEL_MAP=              E4                  #-: 8 Bits  :-#
ADD_TO=                  00                  #-: 8 Bits  :-#
RESAMPLER_CLOCK_DIVIDE=  00                  #-: 8 Bits  :-#
RATIO_0_0=                04000000          #-: 32 Bits :-#
RATIO_0_1=                04000000          #-: 32 Bits :-#
RATIO_0_2=                04000000          #-: 32 Bits :-#
RATIO_0_3=                04000000          #-: 32 Bits :-#
GLOBAL_RESET=              F8                  #-: 8 Bits  :-#
GENERAL_SYNC=              00                  #-: 8 Bits  :-#
COUNT_SYNC=                00                  #-: 8 Bits  :-#
COUNTER=                  ffff                #-: 16 Bits :-#
TRISTATE_CTRL=              FF                  #-: 8 Bits  :-#
OUTPUT_FORMAT=              0E                  #-: 8 Bits  :-#
OUTPUT_MODE=                6C                  #-: 8 Bits  :-#
OUTPUT_FRAME_CTRL=         C0                  #-: 8 Bits  :-#
OUTPUT_WORD_SIZE=           EF                  #-: 8 Bits  :-#
OUTPUT_CLOCK_CTRL=          03                  #-: 8 Bits  :-#
SERIAL_MUX_CTRL=            E4                  #-: 8 Bits  :-#
OUTPUT_TAG_A=                10                  #-: 8 Bits  :-#
OUTPUT_TAG_B=                32                  #-: 8 Bits  :-#
OUTPUT_TAG_C=                54                  #-: 8 Bits  :-#
OUTPUT_TAG_D=                76                  #-: 8 Bits  :-#
#-: Resampler Coefficients Input File :-#
RESAMPLER_COEFF_FILE=resampgsm.dat
GRAY_CHIP_END
```

#-----[ Channel Wide Configuration ]-----#

#-:-----:-#  
#-: Channel Specifier : -#  
#-: Valid Channel Specifier = [1-3][a-d] : -#  
#-:-----:-#

GRAY\_CHIP\_CHANNEL= [ 1a, 1b, 1c, 1d, 2a, 2b, 2c, 2d, 3a, 3b, 3c, 3d ]

#-: Register Name	Register Value	Register Width	:-#
CH_RESET=	0C	#-: 8 Bits	:-#
PHASE=	0000	#-: 16 Bits	:-#
FREQUENCY=	0	#-: 32 Bits	:-#
FREQ_SYNC=	77	#-: 8 Bits	:-#
NCO_SYNC=	72	#-: 8 Bits	:-#
ZPAD_MODE_CTRL=	00	#-: 8 Bits	:-#
DEC_FLUSH_SYNC=	22	#-: 8 Bits	:-#
DEC_RATIO=	703F	#-: 16 Bits	:-#
CIC_SCALE=	64	#-: 8 Bits	:-#
SPLIT_IQ=	00	#-: 8 Bits	:-#
CFIR=	00	#-: 8 Bits	:-#
PFIR=	00	#-: 8 Bits	:-#
INPUT=	00	#-: 8 Bits	:-#
PEAK_CTRL=	00	#-: 8 Bits	:-#
PEAK_COUNT=	00	#-: 8 Bits	:-#
FINE_GAIN=	0300	#-: 16 Bits	:-#

#-: CFIR Coefficients :-#

CFIR\_COEFF\_FILE=cfirrgsm.dat

#-: PFIR Coefficients :-#

PFIR\_COEFF\_FILE=pfirrgsm.dat

GRAY\_CHIP\_CHANNEL\_END

# Chapter 3 Runtime Procedure

---

This chapter provides the procedures you can use to run the demonstration software.

## Running the Demonstration Software

**Note:** Before running the demonstration software, refer to the “Getting Started” section in *Chapter 1 Introduction* for hardware setup information.

### For WinNT/2K

1. Start a command prompt.
2. Go to the directory: .\ECDR-GC314FS\ApplicationCode\Project\Windows\Bin directory
3. Type the following on the console:  
EcdrGc314FsAppCode.exe
4. Go to Step 4.

### For vxWorks

1. Go to the following directory: ./ECDR-GC314FS/ApplicationCode/Project/VxWorks/Bin directory
2. Load the driver and demo software objects at the console:  
ld < EcdrGc314FsAppCode.out
3. Run:  
ecdrGc314FsTest
4. After invoking the Demo Application program, the following menu displays on the screen. Select option 3 to enter the data collection screen. Other options are for test purposes only.

```
-----  
ECDR-GC314-FS Demo Application Software  
Version : 1.1.0 Build 0  
Built on: Aug 3 2003 12:58:26  
Driver Version : 1.0.0 Build 0  
-----
```

```
1. Program ECDR-GC314-FS Flash  
2. Reload ECDR-GC314-FS Firmware  
3. Collect Data  
4. Overrange Check  
5. Timestamp Check  
99. Exit
```

```
--->
```

5. A list of available .ini files found under ./ECDR-GC314FS/ApplicationCode/Project/etc directory is presented. Select the desired .ini file to proceed to the module configuration menu.

```
Searching = [../../etc/*.ini]

Available .ini files

( 0) gc314fsGsm12Ch.ini
( 1) gc314fs_ewb.ini
( 2) gc314fs_wb.ini
( 3) rawAd.ini

Please choose an .ini file ->
```

6. The Configuration menu displays. Within this menu, you can change a variety of functionalities supported by the ECDR-GC314-FS module. See Table 3-1 for the parameters available for each entry listed in the menu.

```
-----
ECDR-GC314-FS Configuration
-----
[ 1] Data Acq Mode = Gate Mode
[ 2] Ext Sync Sel = Ext sync disable
[ 3] IWB Input Sel = Ch2 data
[ 4] GC Input Sel = Raw data
[ 5] Collection Sel= Raw data
[ 6] SIA Sel      = GC SIA Input
[ 7] Data window sz= 8192
[ 8] Skip size    = 0
[ 9] Clock Select = External Clock Enable
[10] Clock Freq   = 105.000000
[11] DownConvert Fq= 32.000000
[12] FIR decimation= Decimate by 2
[13] FIR Coeff Sel = 0
[14] FIR Fine Gain = 0
[15] FIR Coarse Gain= 7
[16] FIR Coeff File = ../../etc/coefdec2.dat
[17] Framing Mode   = RTS + ChID
[18] Frame Size     = 128
[19] Data Framing   = Disabled
[99] Exit
```

Command ->

7. After selecting settings, select 99 to start data collection.
8. The data collected are stored in the ./ECDR-GC314FS/ApplicationCode/Project/data sub-directory.

**Note:** The data files have the following format:

Raw data

sample1

sample2

sample3

...etc

Complex data (IWB or GrayChip)

sample1\_I, sample1\_Q

sample2\_I, sample2\_Q

...etc

**Table 3-1 Configuration Parameters for the ECDR-GC314-FS Module**

Menu Entry	Available Parameters
Data Acq Mode	Selects the acquisition mode. The following three modes are supported. 0 : Gate Mode 1 : Trigger Burst Mode 2 : Trigger Free run Mode
Ext Sync Sel	0 : Ext sync disable 1 : Ext sync enable
IWB Input Sel	Selects the data input to the raw data/Internal Wideband Receiver collection logic. 0 : Zeroes 1 : Ch1 data 2 : Ch2 data 3 : Ch3 data
GC Input Sel	Selects the input to the three GrayChip receivers. 0 : Raw data 1 : IWB Complex data
Collection Sel	Selects what type of data to collect. 0 : Raw data 1 : IWB Data 2 : GC Data

Menu Entry	Available Parameters
SIA Sel	<p>Selects which sync input to be used to synchronize and initialize the GrayChip receivers. Has no impact on the collection. This is used mainly for lab testing only.</p> <p>0 : GC SIA Input 1 : GC SIB Input</p>
Data window sz	Specifies the data window (collection) size
Skip size	Specifies the sample skip size
Clock Select	<p>0 : External Clock Enable 1 : Internal Clock Enable</p>
Clock Freq	Specifies the clock frequency of the clock being selected. The default internal oscillator populated on the board is 40MHz
DownConvert Fq	Specifies the down convert frequency for the GrayChip and IWB receivers.
FIR decimation	<p>Specifies the decimation for the IWB receiver.</p> <p>0 : No decimation 1 : Decimate by 2 2 : Decimate by 3 3 : Decimate by 4</p>
FIR Coeff Sel	Selects which coefficient RAM block to be used. 0 is the default.
FIR Fine Gain	Specifies fine gain for the IWB receiver. This value is dependent on the coefficients being used.
FIR Coarse Gain	Specifies the coarse gain for the IWB receiver. This value is dependent on the coefficients being used.
FIR Coeff File	<p>Specifies the text file that contains the coefficients to be used by the IWB receiver. The following coefficients files are provided as a starting point. The coefficient file used must match the decimation setting of the IWB receiver.</p> <p>( 5) coefdec1.dat – For decimation of 1 ( 6) coefdec2.dat – For decimation of 2 ( 7) coefdec3.dat – For decimation of 3 ( 8) coefdec4.dat – For decimation of 4</p>
Framing Mode	<p>Selects the framing mode when data framing is enabled.</p> <p>0 : RTS + ChID 1 : RTS only</p>

Menu Entry	Available Parameters
Frame Size	Specifies the frame size in samples.
Data Framing	Turns on/off data framing.